PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Improvements relating to an Apparatus for Stretching Synthetic Fibres

We, BARMER MASCHINENFABRIK AKTIENGESELLSCHAFT, a body corporate organised under the laws of Germany, of Wuppertal-Oberbarmen, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to an apparatus for stretching individual synthetic fibres in small groups or bundles of fibres running side by side.

In the production of synthetic monofils or multifils, the filaments are subjected after spinning to a stretching process in which, especially in the case of fully synthetic filaments, they are stretched to several times their original length. The cross-sections of the continuous filaments are thereby reduced and the chain molecules are orientated in the longitudinal direction, and it is only by this longitudinal orientation that the synthetic filaments first acquire their valuable textile properties, especially their high strength. In contradistinction to this, it is well known that during the stretching of slivers or rovings of discontinuous lengths of fibres, on the whole only a displacement of the individual fibres relative to each other takes place.

Arrangements of drums or rollers especially developed for this purpose are used for stretching synthetic filaments. These drums or rollers are arranged in pairs at some distance apart and the speeds at which they are driven differ.

To render the movement of the threads as far as possible free from slip, the threads are wound extensively round the stretching drums or rollers. Thus, for example, it is customary to wind the individual threads several times round the rollers. However, in the case of a bundle comprising a large number of threads delivered in close proximity to each other, such a method is technically impossible to carry out.

In such cases, it was originally customary to use arrangements of stretching rollers comprising several rollers spaced apart in a staggered arrangement with their axes parallel to each other and at right angles to the direction of movement of the threads, the individual threads being placed over one roller and under the next and so forth in meandering fashion so as to make more or less semicircular contact with each roller. However, the arrangement of such groups of rollers in the stretching apparatus takes up a great deal of space since a uniform movement of the threads free from slip can only be achieved if a sufficiently large number of rollers or arcs of contact between roller and thread are arranged behind one another. Moreover, it is not simple, and is accordingly time consuming, to operate such roller trains.

The method was therefore subsequently adopted of using arrangements of clamping rollers in which the threads were passed between one or two lower rollers on the one hand and an upper pressure roller on the other hand. However, such arrangements also have considerable disadvantages since considerable pressure forces have to be applied for stretching bundles of threads in order to ensure that all the moving threads will simultaneously be stretched without slip and in order to prevent individual threads from slipping through. In individual cases, the forces required may be as much as several tons, with the result that both the threads and the surface and bearings of the rollers

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Price 25p

may be subjected to undue stresses. Under less heavy loads, isolated thickenings in the threads or knots may cause the top roller to be lifted briefly with the result that the remaining threads are released for a short time and not stretched during this time. Although these disadvantages can be slightly ameliorated by using rollers covered with an elastic material, such coverings are still subjected to very high stresses at the particular pressure points and hence subject to fairly rapid wear and require constant supervision and frequent replacement.

On the other hand, for stretching individual threads of staple fibres it is known to use belt stretching mechanisms in which a small endless conveyor band for the threads is arranged between a feed roller pair and a delivery roller pair, and this belt is looped round two or more deflecting rollers and brought into abutment against a driven lower roller, a fixed sliding path or another moving belt. According to another proposal, the lower roller, which is covered with an elastic covering, is provided with a magnet which attracts the upper roller pair to the belt. Finally, a belt arrangement comprising four rollers is known in which a cleaning roller is arranged above the belt and rests against the flanges of one of the rollers for the belt, the latter roller in turn resting against the flanges of the lower roller.

Such stretching apparatus comprising a pair of feed rollers and a pair of delivery rollers with a delivery belt arranged between them may be good and useful solutions for stretching slivers and staple fibres since only relatively small tensile forces are involved here which mainly result from the frictional forces between the fibres due to the difference between the speeds of rotation of the feed rollers and the delivery rollers. The purpose of these belt arrangements is to hold and support the sliver of fibres while the pair of delivery rollers displaces the individual fibres in the sliver relative to each other, the thread being stretched as a whole as a result of this pull on the fibres. However, such stretching apparatus with belt support as used in the wool and cotton industry is unsuitable for stretching a plurality of synthetic filaments because a uniform movement of filaments free from slip can no longer be ensured with the use of the known pairs of feed rollers and delivery rollers owing to the higher compression and tension forces required in this case.

Finally, in the technique of conveying materials, it is known to convey flat webs of materials between endless conveyor bands looped round rotating rollers without involving stretching of the material under tension or even controlled stretching of the material conveyed.

The invention is based on the recognition that neither the arrangements of stretching rollers hitherto used nor the usual belt stretching mechanisms or conveyor devices are suitable for stretching synthetic threads. To overcome this defect, the present invention therefore uses for such threads a stretching apparatus in which both the feed clamping region and the delivery clamping region is formed by an endless conveyor band which is tensioned against, or by means of, a pressure roller the pressure roller pressing against the outer peripheral circumference of the band between the two deflecting rollers of the band, the two bands rotating at different speeds. Each of these conveyor bands can be arranged on a special support and designed so that it can be pressed against or tensioned by a pressure roller by means of adjustable, e.g. mechanical, hydraulic or pneumatic pressure means, this being effected in that either the support or the pressure or tensioning roller or both are arranged to be movable to provide the necessary contact between the conveyor band and the pressure roller. The threads or thread bundles run in each case between the pressure or tension roller and the conveyor band which presses against the roller and is thus firmly tensioned. By these means, the clamping force acting on the thread or threads can be made much smaller than that employed in the conventional clamping roller arrangements since the conveyor band increases the size of the area of pressure contact and hence the force of entrainment and reduces or eliminates the possibility of slip. In this arrangement, all the pressing and/or driving elements touching the threads in the region of a particular conveyor band move at practically the same speed whilst one of the two conveyor bands of each apparatus according to the invention rotates at a different speed from that of the other conveyor band. Although the difference in speed may be slight if only a certain amount of stretching by tension is desired in the thread before it is wound, the speed of the second conveyor band may in some cases be several times that of the first conveyor band, depending upon the degree of stretching it is desired to achieve in the thread. The uniformity of stretching of all the threads of a bundle is this ensured and the wear on the elements of the apparatus and the need of readjustment or replacement are reduced to a minimum. Moreover, the apparatus of the invention differs from the conventional belt stretching mechanisms and conveyor devices by the arrangement of two conveyor bands, the difference in speed between the two conveyor bands, the absence of pairs of feed rollers and pairs of delivery rollers and the replacement of one roller of each pair by a conveyor band.

One or both of the deflecting rollers of a conveyor band, which rollers are mounted

in cantilever fashion or at each end of the shaft, may be arranged to be swingable or displaceable on their common support. Similarly, the pressure roller which is cantilevered or mounted at both ends may be swingable or displaceable. The deflecting rollers may be supported by a resilient coupling member which may be common to both rollers. In this way it is possible to adjust the distance between the two deflecting rollers to the length of the conveyor band or to alter it so that when the support and the pressure or tensioning roller or drum are moved towards each other, at least one of the deflecting rollers makes contact with its associated pressure or tension roller or drum by means of the conveyor band looped round it. At that point, the roller pressure is then added to the conveyor band pressure acting on the threads. It is therefore possible to exert a considerably higher pressure at these points of contact with the rollers than in the remaining part of the conveyor band arrangement, and a predeterminable stretching point is therefore obtained near the feed roller for stretching continuously movable synthetic threads. Moreover, owing to the spring pressure of the coupling member, the conveyor band remains tensioned when it is removed from the pressure or tension roller or drum or conversely. Lastly, another advantage is in the fact that when both deflecting rollers of a conveyor band make contact, by means of the part of the conveyor band looped round them, with the pressure or tensioning roller, it will never happen that both deflecting rollers will be lifted at the same time from the pressure or tensioning roller or drum in the event of a knot passing through.

According to a further feature of the invention, an additional counter roller acting on the conveyor band may be provided and this may be mounted either in a fixed position or movably and if desired, also on the support of the deflecting rollers. In this case, arrangements are possible in which one or both deflecting rollers make contact with the counter roller by means of the part of the conveyor band looped round the said deflecting roller or rollers.

In the first instance, the conveyor band may in principle be driven by the clamping roller which acts as pressure or tensioning roller. However, since in the process of stretching a thread bundle comprising a plurality of threads running close together side by side the conveyor band is no longer, or only partly, in direct contact with the driving clamping roller, it is advantageous also to drive the conveyor band itself, e.g. by means of one or both deflecting rollers or even by means of the counter roller. The latter arrangement has the advantage that the conveyor band can always be driven at the same peripheral speed even if it is worn down.

However, since the apparatus can also be operated with both conveyor bands running at the same speed, it can also advantageously be used for conveying or delivering individual or groups or bundles of synthetic threads.

Some embodiments of the invention are shown diagrammatically in the accompanying drawing in which:

Fig. 1 shows the two elements of a stretching apparatus, each comprising a conveyor band and pressure or tensioning roller, both arranged differently,

Fig. 2 shows two rollers each in contact with the conveyor band,

Figs. 3 to 5 show the conveyor band with different arrangements of the deflecting-, pressure- and counter-rollers.

In a stretching apparatus according to Fig. 1 for a thread bundle with a plurality of synthetic threads 1 running parallel side by side, two conveyor elements 2 and 3 each comprise an endless conveyor band 8 or 9 respectively looped round deflecting rollers 4 and 5 or 6 and 7 respectively, and a pressure or tension roller 10 or 11 respectively cooperating therewith. The arrangement of the cooperating parts 8, 10 or 9, 11 of the two elements 2, 3 in relation to each other may be the same or different. In the example illustrated, in one case, namely in the case of the element 2, the conveyor band 8 with its two deflecting rollers 4 and 5 is firmly mounted on the frame or support 12 whilst the pressure roller 10 is arranged to be adjustable in the direction of the conveyor band 8 by the action of the piston rod 13 of the hydraulic loading device 14 in the frame 12. In the case of the element 3, the tensioning roller 11 is mounted in a fixed position in the frame or support 15 whilst the conveyor band 9 with its two deflecting rollers 6 and 7 and the support 16 carrying them is displaceable in and relative to the framework 15 by the action of the piston rod 17 of the hydraulic loading device 18 acting on the support 16. The conveyor band 8 may be driven by one or both deflecting rollers 4 and 5, and the conveyor band 9 may be driven by the tensioning roller 11. The thread bundle running into and out of the apparatus over the thread-deflecting rollers 19 and 20 respectively is guided between the two conveyor bands 8 and 9 and the associated pressure or tensioning rollers 10 and 11 respectively and thus firmly clamped so that all the threads will be stretched to the desired extent without slip owing to the higher speed of the conveyor band 9 and adjacent tensioning roller 11 compared with the speed of the conveyor band 8 and adjacent pressure roller 10, the speed of the conveyor band

9 being possibly several times that of the band 8.

Fig. 2 shows a similar arrangement of conveyor bands 21 and 22 with a pair of rollers 23, 24 over which run one or several threads 25 without being looped several times round each roller as was hitherto the case, and the conveyor band is applied at a suitable contact pressure against the roller or conversely, so that the threads are conveyed and stretched without slip as desired as a result of the possibly several times greater speed of the second roller compared with the first.

According to Fig. 3, the deflecting rollers 26 and 27 of the conveyor band 29 which is in contact with the pressure or tension roller 28 can be arranged to be displaceable on swivel arms or in slot guides indicated at 30 and 31 respectively so that even in the event of the conveyor band undergoing an increase in length, the deflecting rollers will be kept in direct contact with the pressure or tension roller through the tensioned conveyor band.

Figure 4 shows the same arrangement of the conveyor band 8 as Fig. 1 but an additional counter-roller is provided on the frame, this counter roller acting on the conveyor band from outside and in turn being if necessary displaceable in the direction of the conveyor band. A similar arrangement is shown in Fig. 5 in which the deflecting rollers 4 and 5 are connected together through a spring-supported coupling link 33 and they can be arranged to be pushed together to such an extent that one of the rollers, i.e. the roller 4 can be brought into direct contact with the pressure roller 10 and if desired also with the counter-roller 32 through the conveyor band. Finally, the arrangement may be such that both deflecting rollers make contact both with the clamping roller and with the counter roller, in which case the conveyor band can be driven either by the clamping roller or by the counter-roller or both.

WHAT WE CLAIM IS:—

1. An apparatus for stretching individual or groups or bundles of synthetic threads running side by side by means of endless conveyor bands looped round rotatable rollers, wherein clamping regions both at the input and a delivery end of the apparatus are each formed by an endless conveyor band tensioned against and by means of a pressure roller, the pressure roller acting on the outer surface of the band between two deflecting rollers of the band, and the two bands rotating at different speeds.

2. An apparatus according to claim 1, wherein one or both of the deflecting rollers of a conveyor band, are swingable or displaceable on a common support.

3. An apparatus according to claim 1 or claim 2, wherein the pressure roller is arranged to be swingable or displaceable.

4. An apparatus according to any preceding claim wherein one or both deflecting rollers are supported by a yielding coupling member.

5. An apparatus according to any preceding claim comprising in addition a counter roller arranged to act on the conveyor band.

6. An apparatus according to any preceding claim wherein the conveyor band is driven by one or both deflecting rollers.

7. An apparatus according to any of claims 1 to 5 wherein the conveyor band is driven by the pressure roller or the counter-roller or both.

8. An apparatus for stretching synthetic threads substantially as described with reference to the accompanying drawings.

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1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

FIG. 1.

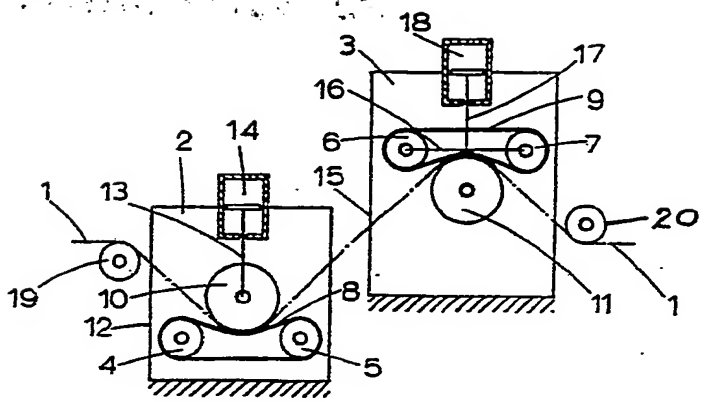

FIG. 2.

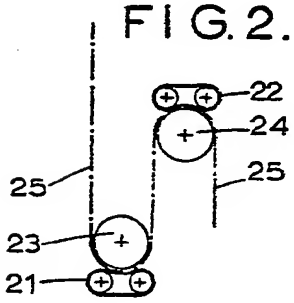

FIG. 3.

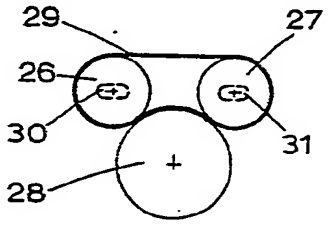

FIG. 4.

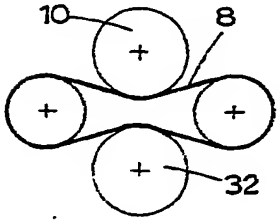

FIG. 5.